

**STATE OF OHIO
DEPARTMENT OF TRANSPORTATION**

**SUPPLEMENT 1047
PAVEMENT MARKING MATERIALS
PRODUCT EVALUATION AND APPROVAL PROCESS**

January 16, 2009

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1047.01 Description. This supplement describes the evaluation and acceptance procedures for traffic marking products listed on the Department's Approved List as products meeting the requirements of Item 740 or other traffic marking specifications the Department develops and publishes.

The Department will only accept pavement marking materials listed on the Approved List and provided by manufacturers conforming to Supplement 1089.

1047.02 Submittal Procedures

Step 1 Initial Submittal to New Products

All traffic marking product developments, revisions and advances will be submitted through the Department's new products process. The New Products Engineer (NPE) will be responsible for process management.

In addition to the information required under the new products process, traffic marking product will include, if available, a documentation submittal of the following data:

- A. What generic marking type is the proposed product and
 - i. what generic Department 740 specification does the product conform toor
 - ii. what generic Department 740 specification would the product compete against
- B. Actual NTPEP Field service testing/evaluation under traffic comparing the new product versus a Department approved product of the generic type described in

- A and including:
 - i. Durability data
 - ii. Reflectivity data
 - iii. Color data
 - iv. Bead data
 - v. Application data
 - vi. Traffic data
 - vii. Weather data
 - viii. Limitations

- C. Actual Field service testing/evaluation, other than NTPEP, under traffic comparing the new product versus a Department approved product of the generic type described in A and including:
 - i. Durability data
 - ii. Reflectivity data
 - iii. Color data
 - iv. Bead data
 - v. Application data
 - vi. Traffic data
 - vii. Weather data
 - viii. Limitations

- D. Actual applied cost data on the proposed product. Submit at least two cost estimates, with assumptions made about project size, from ODOT approved striping contractors. Also submit cost per year data for claimed performance period.

- E. If the submitter has no actual field performance data, provide laboratory evaluation data of the product versus a Department approved product of the generic type described in A that evaluates similar performance factors listed in B.

When the NPE receives the required data submittal, the NPE will notify the Pavement Striping Committee (PSC) that a complete submittal has been made and ready for review. The PSC will include:

New Products Engineer
Traffic Specification Committee Chair
Office of Traffic Engineering Representative
Office of Materials Management Representative
District Pavement Marking Representative
District Construction Representative.

Step 2 Pavement Striping Committee Evaluation

The PSC will meet at least quarterly to determine the status of any proposed new

product. The committee general status options will include:

- A. No Departmental Interest status
 - i. The PSC determines the product provides the Department with no enhanced performance advantage, no cost advantage, or combination of both.
- B. Preliminary Evaluation status
 - i. The PSC determines the product's initial data requires additional testing, field performance or additional information. The PSC may target the items listed in Appendix B when making this determination. The manufacturer will be provided a scope of additional requirements and may include:
 - 1. Submittal and application on NTPEP test decks
 - 2. Materials and application on Department determined test sites within Ohio
 - 3. Additional materials testing, evaluation and data submittal
 - 4. Additional cost evaluation.
- C. Conditional Acceptance status
 - i. The PSC determines the product's initial data supports trial use as a conditional product on the Department's Approved List. The PSC may target the items listed in Appendix B when making this determination. Conditional approval may limit the products use:
 - 1. to a specific number of projects
 - 2. regional location acceptance
 - 3. based on environmental conditions
 - 4. to a temporary versus permanent application
 - 5. to a specific period of time and until a final evaluation of the performance in ODOT applications is determined.
- D. Full Acceptance status
 - i. The PSC determines the product's initial data supports full acceptance.
 - 1. The full acceptance approval is typically limited to minor formulation changes in a currently approved product.

Step 3 No Departmental Interest status

If the PSC designated the new striping product as “No Departmental Interest status” (Step 2 A), the NPE will inform the submitter in writing of the Department's decision and that no further evaluation or action will be taken on the submitted striping product.

Step 4 Preliminary Evaluation status

If the PSC evaluation of the striping product assigns “Preliminary Evaluation status” (Step 2 B) the committee will define additional evaluation requirements for the product. The NPE will notify the submitter of the committee's decision and additional evaluation

requirements. The submitter will absorb any additional costs due the PSC's additional evaluation requirements.

Within thirty (30) days after the NPE notification, the submitter will notify the NPE in writing whether or not they intend to comply with the PSC requirements. If the submitter chooses to continue the traffic marking evaluation process, the PSC will establish schedules and sites. Subjective criteria listed in Appendix C, D, and E may be used as a part of the evaluation.

Step 5 Conditional Acceptance status

If the PSC evaluation of the striping product assigns "Conditional Acceptance status" (Step 2 C), the committee will define the conditional acceptance level and requirements and time period of the conditional status. The NPE will notify the submitter of the committee's decision and requirements.

Conditional evaluations will be at no cost to the submitter. The PSC will perform the evaluation at any specified times and conditions. Subjective criteria listed in Appendix C, D, and E may be used as a part of the evaluation. The PSC will determine whether the conditional product can be moved to Full Acceptance status within sixty (60) days of the end of the required conditional evaluation time period.

Step 6 Full Acceptance Status

If the PSC evaluation of the striping product assigns "Full Acceptance status" (Step 2 D), the NPE will notify the submitter of the committee's decision and requirements. The striping product will be included on the Department's Approved List with no restrictions.

1047.03 NTPEP Field Service Testing. Submitters are encouraged to use NTPEP for field service testing. The PSC will normally give more weight to NTPEP performance than company test sites or laboratory performance.

A. **Test Line Installation.** The service test lines will be applied at a selected location under the auspices of NTPEP. The PSC considers the Pennsylvania NTPEP test deck the most representative of ODOT conditions. The Wisconsin test deck is considered next followed by all other NTPEP test decks. Any required surface preparation, primer, adhesive or activator shall be performed and shall become part of the material system for subsequent approval or use.

B. PSC Field Service Pavement Marking Evaluation Criteria.

TRAFFIC PAINT TYPE 1 (Item 740.02) Water-based 100 percent acrylic type

For traffic paint type 1 pavement marking materials, the PSC will evaluate 2 YEAR NTPEP field performance data. The following criteria is the PSC's basic measure of effectiveness:

- i) Durability

(a) 8.0 and above for white and yellow colors of paint on asphalt and concrete surfaces at left wheel and skip line areas.

ii) Dry Time

(a) 2 minutes and less for white and yellow colors of paint on asphalt and concrete surfaces.

iii) Retroreflectivity

(a) 325 mcd/m²/lux and above for white markings for both asphalt and concrete surfaces at skip line area only.

(b) 200 mcd/m²/lux and above for yellow markings for both asphalt and concrete surfaces at skip line area only.

iv) Color – See Appendix A for requirements.

POLYESTER PAVEMENT MARKING (Item 740.03)

For polyester pavement marking materials, the PSC will evaluate 2 YEAR NTPEP field performance data. The following criteria is the PSC's basic measure of effectiveness:

i) Durability

(a) 9.0 for white and yellow colors of polyester pavement marking on asphalt and concrete surface at skip line area only.

ii) Retroreflectivity

(a) 300 mcd/m²/lux and above for white polyester pavement marking on asphalt and concrete surfaces at skip line area only.

(b) 200 mcd/m²/lux and above for yellow polyester pavement marking on asphalt and concrete surfaces at skip line area only.

iii) Color - See Appendix A for requirements.

THERMOPLASTIC PAVEMENT MARKING (Item 740.04)

For thermoplastic pavement marking materials, the PSC will evaluate 2 YEAR NTPEP field performance data. The following criteria are the PSC's basic measure of effectiveness:

i) Durability

(a) 10.0 for white and yellow colors of thermoplastic on asphalt and concrete surface at left wheel and skip line areas.

ii) Retroreflectivity

(a) 450 mcd/m²/lux and above for white thermoplastic on asphalt and concrete surfaces at skip line area only.

(b) 175 mcd/m²/lux and above for white thermoplastic on asphalt and concrete surfaces at left wheel area only.

(c) 225 mcd/m²/lux and above for yellow thermoplastic on asphalt and concrete surfaces at skip line area only.

(d) 125 mcd/m²/lux and above for yellow thermoplastic on asphalt and concrete surfaces at left wheel area only.

iii) Color - See Appendix A for requirements.

PREFORMED PAVEMENT MARKING (Item 740.05)

For preformed pavement marking materials, the PSC will evaluate 2 YEAR NTPEP field performance data. The following criteria are the PSC's basic measure of effectiveness:

i) Durability

(a) 10.0 for white and yellow colors of preformed pavement marking on asphalt and concrete surface at left wheel and skip line area.

ii) Retroreflectivity

(a) 350 mcd/m²/lux and above for white preformed pavement marking on asphalt and concrete surfaces at skip line area only.

(b) 150 mcd/m²/lux and above for white preformed pavement marking on asphalt and concrete surfaces at left wheel area only.

(c) 250 mcd/m²/lux and above for yellow preformed pavement marking on asphalt and concrete surfaces at skip line area only.

(d) 150 mcd/m²/lux and above for yellow preformed pavement marking on asphalt and concrete surfaces at left wheel area only.

iii) Color - See Appendix A for requirements.

EPOXY PAVEMENT MARKING (Item 740.07)

For epoxy pavement marking materials, the PSC will evaluate 2 YEAR NTPEP field performance data. The following criteria are the PSC's basic measure of effectiveness:

- i) Durability
 - (a) 10.0 for white and yellow colors of epoxy on asphalt and concrete surface at skip line area only.
 - (b) 9.0 for white and yellow colors of epoxy on asphalt and concrete surface at left wheel area only.
- ii) Retroreflectivity
 - (a) 300 mcd/m²/lux and above for white epoxy on asphalt and concrete surfaces at skip line area only.
 - (b) 125 mcd/m²/lux and above for white epoxy on asphalt and concrete surfaces at left wheel area only.
 - (c) 200 mcd/m²/lux and above for yellow epoxy on asphalt and concrete surfaces at skip line area only.
 - (d) 100 mcd/m²/lux and above for yellow epoxy on asphalt and concrete surfaces at left wheel area only.
- iii) Color - See Appendix A for requirements.

HEAT-FUSED PREFORMED THERMOPLASTIC PAVEMENT MARKING (Item 740.08)

For heat-fused preformed thermoplastic pavement marking materials, the PSC will evaluate 2 YEAR NTPEP field performance data. The following criteria are the PSC's basic measure of effectiveness:

- i) Durability
 - (a) 10.0 for white heat-fused preformed thermoplastic on asphalt and concrete surface at left wheel and skip line areas.
- ii) Retroreflectivity
 - (a) 275 mcd/m²/lux and above for white heat-fused preformed thermoplastic on asphalt and concrete surfaces at skip line area only.
 - (b) 150 mcd/m²/lux and above for white heat-fused preformed thermoplastic on asphalt and concrete surfaces at left wheel area only.

iii) Color - See Appendix A for requirements.

1047.04 Removal of Traffic Marking Products from the Approved List. The PSC may remove pavement marking material from the Approved List if in ODOT's sole discretion the material has failed to perform at a satisfactory level in the field or does not meet the criteria per 1047.03.

1047.05 Reapproval. A pavement marking material removed from the Approved List due to unsatisfactory field performance will not be returned to the list until the manufacturer identifies the reason for the failure, the problem has been corrected, the product has been resubmitted conforming to this supplement and the PSC determines the product should have full acceptance status.

1047.06 Modifications to Prequalified Pavement Marking Materials. While the Department recognizes manufacturers will occasionally modify certain aspects of their products in an effort to enhance performance, improve durability, reduce costs, etc., it also recognizes manufacturers are responsible for providing performance data to support changes to the original product.

Pavement marking material manufacturers will notify ODOT whenever any modifications are made to products contained on the Approved List. Manufacturers will also submit performance data they feel supports the basis for their revision not decreasing the performance or enhancing the performance. The PSC will review the changes and the performance data following 1047.02 and determine the product's new status. .

1047.07 Annual Recertification By January 1st of each calendar year manufacturers must recertify that the pavement marking materials supplied meets or exceeds the requirements of S 1047.03. Modifications to supplied materials shall be addressed per 1047.06. Pavement marking materials not recertified will be removed from the QPL effective February 1st.

APPENDIX A –Color Requirements

To test the pavement marking colors either in the field or in the lab, the color coordinates listed in Table A [based on Daytime Geometry - 45/0 (0/45), CIE illuminant D65 and CIE 1931 (2 °) standard observer] shall be used.

White Color Requirements

| | Daytime Chromaticity Coordinates (Corner Points) | | | | | | | |
|-------|--|-------|-------|-------|-------|-------|-------|-------|
| | 1 | | 2 | | 3 | | 4 | |
| | x | y | x | y | x | y | x | y |
| White | 0.355 | 0.355 | 0.305 | 0.305 | 0.285 | 0.325 | 0.335 | 0.375 |

Yellow Color Requirements

| | Daytime Chromaticity Coordinates (Corner Points) | | | | | | | |
|--------|--|-------|-------|-------|-------|-------|-------|-------|
| | 1 | | 2 | | 3 | | 4 | |
| | x | y | x | y | x | y | x | y |
| Yellow | 0.560 | 0.440 | 0.490 | 0.510 | 0.420 | 0.440 | 0.460 | 0.400 |

Appendix B

The PSC will follow these guidelines when evaluating the submitted information for determining level of acceptance.

Durability data

- Marking thickness vs ODOT specification required thickness
- Pavement type (old / new concrete or asphalt)
- Adhesion to existing markings
- Application equipment and method
- Surface preparation
- Durability vs age
- Traffic
- Weather

Reflectivity data

- Marking thickness vs ODOT specification required thickness
- Pavement type (old / new concrete or asphalt)
- Application equipment and method
- Bead – type, gradation, coating, application weight, roundness vs ODOT specification
- Reflectivity vs age
- Traffic
- Weather

Color data

- Daytime / nighttime color with and without beads
- Color drift over time

Application data

- Required application equipment vs standards available within ODOT and industry
- Required application method vs ODOT standard specification requirements
- Speed
- Weather limitations
- Equipment modification costs
- Dry time vs weather
- Safety and health limitations

Traffic data

- Average daily traffic
- Average daily truck traffic

Weather data

- Average monthly temperature, humidity, rainfall, snowfall of test site applications
- Monthly high/low - temperature, humidity, rainfall, snowfall of test site applications

Cost data

- Installed cost per mile - edge line and lane line (quantity basis for cost)
- Installed cost per each - symbol marking
- Material cost / gallon or pound
- Bead cost / pound

Appendix C

Daytime Color of Long Line Pavement Marking

The color rating is a subjective field assessment of the vividness of the white markings and the richness of the yellow markings when viewed under dispersed daylight conditions on dry pavement, in accordance with the table below.

Ideally, color should be assessed under uniformly overcast conditions. If it is necessary to conduct evaluations under clear or partly cloudy conditions, the color assessment should be made with the sun as near transit as practical, as the angle of the incident rays of the sun can have a significant effect on the appearance of the color of the pavement markings. Viewing the line with the sun behind and low on the horizon should be avoided, as this can impart a level of retroreflectivity to the pavement marking. Under certain circumstances, especially during the fall and winter, when the sun is low on the horizon even at transit, it may be necessary to view the line in the opposite direction to avoid excessive retroreflectivity imparted from the sun.

The evaluation process is conducted as follows: A trained evaluator observes the line from a distance of 100 feet (± 10 feet), and rates the color as per the table below. For lane lines, this distance can be approximated by standing midway between two lane lines, and looking beyond the nearest two lane lines to the third.

In all cases, the color rating is expressed as an integer value.

| Daytime Color (line viewed at a distance of 100 feet) | |
|---|---|
| 10 | White and yellow are very vivid and rich in appearance, and are very effective in delineation |
| 9 8 7 | White and yellow are very distinctive and definite in color |
| 6 5 4 | White and yellow appear somewhat grayish; yellow may appear to have a brownish or greenish tint |
| 3 2 1 | White and yellow are dull and grayish; yellow may appear to be green, brown or off-white |
| 0 | White and yellow appear very dull |

Appendix D

Night Visibility Rating of Long Line Pavement Marking

Night visibility is a subjective rating based on the appearance of the pavement marking line on dry pavement to a trained evaluator in a vehicle when viewed under low beam headlight illumination at night. The night visibility rating consists of an evaluation of three distinct attributes:

Uniformity – The ability of the line to provide a consistent, unvarying appearance along its length and across its width.

Retroreflectivity – The brightness of the line in the return of incident illumination.

Nighttime Color – The vividness of the white markings and the richness of the yellow markings when seen with retroreflected light.

The rating scales for each of these attributes is described in the tables below.

The evaluation process is conducted as follows: With appropriate traffic control in place, slowly drive through the test section at night with low beam headlights, and observe the test line. First, rate the uniformity of the line appearance. Second, rate the line retroreflectivity. Finally, rate the color. Add up the three individual scores to get a composite rating for the line.

In all cases, the night visibility rating is expressed as an integer value.

| Uniformity | |
|------------|---|
| +4 | Line is completely consistent in appearance, with no distinguishable variations |
| +3 | Line is generally consistent in appearance, with minimal variations |
| +2 | Line is generally consistent in appearance, but with distinctly brighter and darker areas |
| +1 | Line is inconsistent in appearance, with distinctly brighter and darker areas |
| 0 | Line is very inconsistent in appearance and may appear blotchy |

| Retroreflectivity | |
|-------------------|--|
| +3 | Line is very bright |
| +2 | Line is bright |
| +1 | Line appears adequate, but with unimpressive brightness |
| 0 | Line has minimal brightness; line is discernable but only marginally effective |

| Nighttime Color | |
|-----------------|---|
| +3 | White appears as very clean reflected light; yellow is distinctive and definite in color |
| +2 | White and yellow appear somewhat grayish; yellow may appear to have a brownish or greenish tint |
| +1 | White and yellow are dull and grayish; yellow may appear to be green, brown or off-white |
| 0 | White and yellow appear very dull |

Appendix E

Durability of Long Line Pavement Marking

Durability is the rating of the adherence of the pavement marking material to the sound pavement surface, based on the percentage of the material remaining adhered. Durability is not an assessment of the thickness of the material or retention of optical elements, but rather an analysis of the amount of bare, sound pavement showing that was once covered with pavement marking material.

Durability is an objective assessment, although there exists no mechanical means to reliably and quickly measure durability in the field. Therefore, the field assessment of pavement marking durability must be made by trained evaluators.

The evaluation process is conducted as follows: Several trained evaluators observe the test line by viewing vertically from above. An assessment of the durability is made by each. The durability rating is agreed upon in the field by a consensus of the evaluators.

If line deterioration is inconsistent throughout the length of the test section, several line segments should be evaluated. Each segment should be a minimum of ten feet in length, and no less than 2% of the total length of the line. The durability rating is the lowest rating for any line segment, as agreed upon by a consensus of the evaluators.

Portions of the line subjected to unusual wear, such as at driveways or from line tracking prior to final curing, should be categorically excluded from the durability assessment. In addition, failures within the pavement must be recognized and discounted when assessing the durability of the pavement marking.

In all cases, the durability rating is expressed as an integer value.

| Durability | |
|------------|------------------------------|
| Rating | Percentage of Line Remaining |
| 10 | 100 |
| 9 | 90 |
| 8 | 80 |
| 7 | 70 |
| 6 | 60 |
| 5 | 50 |

| Durability | |
|------------|------------------------------|
| Rating | Percentage of Line Remaining |
| 4 | 40 |
| 3 | 30 |
| 2 | 20 |
| 1 | 10 |
| 0 | 0 |